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THESIS

Three Case Studies

of Management Information Systems

by

Marc W. The'berge

September, 1990

Thesis Advisor: William James Haga

Second Reader: Moshe Zviran

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91-05150

91 7 16 024

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Naval Postgraduate School 6b. OFFICE SYMBOL (*If applicable*) 55	7a. NAME OF MONITORING ORGANIZATION Naval Postgraduate School
6c. ADDRESS (*City, State, and ZIP Code*) Monterey, CA 93943-5000	7b. ADDRESS (*City, State, and ZIP Code*) Monterey, CA 93943-5000
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b OFFICE SYMBOL (*If applicable*)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (*City, State, and ZIP Code*)	10. SOURCE OF FUNDING NUMBERS Program Element No. / Project No / Task No. / Work Unit Accession Number

11. TITLE (*Include Security Classification*)
THREE CASE STUDIES OF MANAGEMENT INFORMATION SYSTEMS (Unclassified)

12. PERSONAL AUTHOR(S) Theberge, Marc W.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (*year, month, day*)	15. PAGE COUNT
Master's Thesis	From To	1990 September 13	55

16. SUPPLEMENTARY NOTATION
The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

17. COSATI CODES			18. SUBJECT TERMS (*continue on reverse if necessary and identify by block number*)
FIELD	GROUP	SUBGROUP	Case Studies, Database Management Systems, Local Area Networks, Decision Support

19. ABSTRACT (*continue on reverse if necessary and identify by block number*)

The Naval Postgraduate School must, by default, make use of teaching cases in information technology case studies oriented or based upon corporations. It has been difficult for the school to obtain such studies oriented to the military, much less the United States Navy.

This thesis provides the Naval Postgraduate School with three teaching cases concerning automated information systems serving the administrative and operational needs of unit-level command organizations.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION	
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS REPORT ☐ DTIC USERS	Unclassified	
22a NAME OF RESPONSIBLE INDIVIDUAL William J. Haga	22b TELEPHONE (*Include Area code*) (408) 646-1489	22c. OFFICE SYMBOL AS/HG

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

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Three Case Studies of Management Information Systems

by

Marc W. The'berge
Lieutenant, United States Navy
B.S., United States Naval Academy, 1983

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

NAVAL POSTGRADUATE SCHOOL
September 1990

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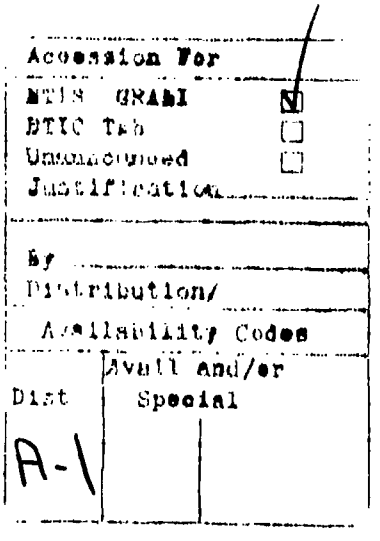
ABSTRACT

The Naval Postgraduate School must, by default, make use of teaching cases in information technology case studies oriented or based upon corporations. It has been difficult for the school to obtain such studies oriented to the military, much less the United States Navy.

This thesis provides the Naval Postgraduate School with three teaching cases concerning automated information systems serving the administrative and operational needs of unit-level command organizations.



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I. INTRODUCTION

A case study is a process by which learning experiences are related to students through the posing and solution of a problem in order that some educational benefit be attained.

The written expression of a noteworthy, information technology-related problem to be solved by students in the context of a case study is the challenge met by this thesis.

This thesis is concerned with studying and constructing militarily-oriented case studies in order to instruct Computer System Management (CSM) students at the Naval Postgraduate School (NPS). Specifically, the instruction is aimed at instances of automated information management performing routine, yet normally manpower-intensive, tasks facing the officers and men of the United States Navy.

The U. S. Navy needs case studies in management situations peculiar to its own operating environment. Developments in information technology need to be demonstrated to military graduate students in their own operating language. A better understanding of the information management problems found in the fleet will be gained by NPS instructors and students alike from cases based upon actual fleet experience.

The author's experiences as a naval aviator in a helicopter squadron aboard an aircraft carrier from 1986

through 1988 provided the insight and research material for the case studies to be presented. Those experiences also provide the framework and dictate the setting for each of the case studies.

Computer system management education received at the Naval Postgraduate School has been enlightening yet not well-suited to fleet applications faced by most junior naval officers. Most examples of information management and technology in teaching cases are geared toward experiences in the civilian corporation world.

A. Objectives

The objectives of this thesis are threefold. The first objective is to establish a precedent for Naval Postgraduate School students to develop their own fleet experiences into instructional lessons through the case study tool. The second objective is to provide insights into applications of data-processing technology for the hardware and software already existing in the fleet. The third objective is to encourage the development of new and innovative information systems applications for the United States Navy.

B. Research Questions

1. Can the introduction of computer-based information systems and the implementation of database technology improve the maintenance of performance records for the operations department of a unit-level command?

2. Can tactical antisubmarine warfare (ASW) efficiency be improved by local area network technology?

3. Can a decision support system (DSS) enhance tactical shipboard readiness and training?

C. Areas of Research

Specific areas of research and writing are: information systems management, database systems, local area network technology; and decision support systems. These subject areas will be demonstrated through fleet examples in a carrier-borne helicopter squadron.

The compilation of operational reports generated on a unit command level demands the utmost in coordination from all departments and divisions in the organization. The institution of a database as a tool of preparation for the organization's reports and record-keeping would enhance the quality of important statements as well as ease some of the strain of coordination on those responsible for the groundwork of summary reports. The implementation of an organizational database designed to quickly and efficiently compile the operational reports for a unit command-level USN organization is the subject of the first case study.

Antisubmarine warfare (ASW) is an information-intensive effort. Killing a submarine means a high price paid in the form of acoustic sensors and the technology necessary to coordinate the information which those sensors produce. The coordination of that ASW information allows for an eventual targeting solution of the underwater platform. It is critical to the ASW effort to employ a command and control center of information which can develop and execute an ASW evolution. This center is normally the ASW Module of an aircraft carrier. The various inputs to this center of command and control are varied and numerous. At present, there is very little state-of-the-art technology applied to the methods which this information is handled. ASW information is still being processed in much the same manner as it was in the late 1950's. It lacks automated data processing. The incorporation of a local area network (LAN) inside the ASW command and control center so as to improve the efficiency of the information processing and dissemination is the subject of the second case study.

Decision support systems can be designed to reduce the strain of command decision-making when alternatives and their probabilities can be modeled and programmed to compute a solution. Specific tactical environments give rise to programmed solutions derived through decision support systems. Decision support system technology can improve command-level warfare training by presenting crucial alternatives and their

respective probabilities for consideration to decision-makers. The processing of ASW contact information and the resultant initial actions of a capital ship is the subject of the third case study.

The case studies presented here are an attempt to bring home the practicality of information technology to solving pertinent and common operational and administrative challenges in the United States Navy at unit-level commands.

The research conducted was rather unique in that it consisted purely of fleet experience. Each of the three case studies which make up this thesis is based on actual events which took place in the author's experience.

The importance of this research effort is underlined by the fact that research was done in the fleet. This research will demonstrate to students at the Naval Postgraduate School that fleet information management problems can be solved by fleet personnel using hardware and software in place in the fleet today.

This research consists of the development of three case studies demonstrating naval applications of management information systems technology. The three case studies are concerned with the following specific areas: information systems management and database systems; local area network technology; and decision support systems.

Each of these areas will be introduced and developed in the format of a case study for graduate-level students.

Students will be asked to develop solutions to problem cases involving typical information resource management challenges to US armed forces.

II. TEACHING CASE 1: MAN OVERBOARD

The time was 1730 aboard USS Ranger, an aircraft carrier. Four helicopter aircrewmen walked toward the 'stack' during a lull in flight ops to preflight their helicopter for a night launch. Their heads were swiveling to keep themselves out of trouble. On a carrier flight deck, everything you don't see will not only hurt you--it'll kill you! It was 75 days into a scheduled 90-day line period in the Indian Ocean.

The helicopter aircraft commander of an SH-3 Sea King helicopter (HAC) was a newly frocked commander with the call sign of Ozone. He was the Operations Officer for the

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This case was prepared by Lieutenant Marc The'berge, USN, while a student at the Naval Postgraduate School, under the direction of Prof. William Haga. It is designed as a basis for class discussion.

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helicopter squadron onboard. Ozone was a rising star in naval aviation. Everybody knew he would be selected for aviation command at the next selection board. He had an outstanding record. He was a good pilot, personable, usually quite efficient and politician among naval officers. The H2P, or second pilot, was Ltjg. McMahon, new to carrier aviation life. McMahon went by 'Carrot' for his bright red hair.

He listened to every word out of Ozone. Carrot wanted to be just like Ozone!

Ozone and Carrot preflighted their aircraft. Afterwards they retired to the squadron wardroom for coffee and a night of standing Alert 30. The Alert 30 was an overnight watch where the aircrew would be standing by to launch in the case of an emergency (e.g., medical evacuation or man overboard rescue). The aircrew could sleep or eat or watch television but they had to be ready to fly on 30 minutes notice.

As the Ops officer, Ozone was responsible for the daily flight operations of the helo squadron. It was his responsibility to ensure that each helo pilot flew enough hours each month to maintain a high flying proficiency. Also, it was his business to make sure that each pilot flew with all the requisite qualifications such as night proficiency, Natops (Naval Aviation Training and Operations Procedures) and instrument flight.

Lately, flight operations had been day-intensive. It was becoming difficult to keep all the squadron's pilots night

qualified. A helo pilot had to fly once at night every two weeks to be considered safe and legal in accordance with Natops and squadron operating procedures. Records of flight frequency were maintained by the Ozone's squadron operations department.

The records of squadron flights were kept by two junior enlisted men. Both of them were third class petty officer rescue swimmers. Highly-trained and motivated to jump from helicopters to rescue aircrew adrift in the ocean, they were not enthusiastic about flight record maintenance. They were not supervised in how they kept flight and qualification records. These records were kept up-to-date on accounting-type ledgers. The records were maintained manually although the squadron had a personal computer and database management system software in the same workspace.

The young petty officers made it a practice to keep up with recording as much as they could. Because they weren't troublemakers the division chief didn't bother with them. The database for the squadron's record of flights consisted of four stacks of incomplete ledgers each holding about a thousand flight records.

Ozone knew all this; he expected his successor to clear up this problem.

Night alerts lasted twelve hours. The night alert crew was briefed and posted at 1800 each night and relieved each morning at 0600.

The time was 0300. Ranger was sliding through the black waves of the Indian Ocean. A starboard lookout noticed a red light passing by the side of the ship. "Man Overboard!" sounded the alarm.

Ozone had turned in for the night. So had the enlisted aircrewmen. Carrot was watching a movie in the squadron ready room that was well beneath his dignity.

When the alarm sounded over the ship's loudspeakers, Carrot grabbed his flight gear and headed for the flight deck with the conviction of a modern-day hero on his way to rescue a hapless shipmate. Carrot made it to the pre-positioned helo in two minutes. Already, the entire flight deck was coming to life in the dark. Flight deck personnel were preparing for a launch in their sleep, some in their underwear.

Carrot got both engines lit off in another two minutes. The checklists weren't meant for this type of situation. The aircraft was ready to engage its rotors in six minutes flat! That was a record for the helo squadron!

Ozone was definitely getting too old for this kind of thing. Ten minutes after the alarm, he made it to the aircraft. His mind was in a fog of sleep when the rotor blades started to turn. The helo launched eighteen minutes after the alarm. It was dark---very dark, something helo pilots called 'Varsity Dark.' It was a demanding flight environment. Even for an aviation commander with Ozone's experience. There was no horizon.

Ozone asked for a vector to the light in the water. He didn't get an answer on the radio. He tried the other radio and the result was the same. He was handling two radios, flying the helo and trying to save a life simultaneously. He didn't trust his young and inexperienced copilot in this situation.

Ozone prepared a manual approach to a hover altitude of 40 feet above the water. A descent performed manually is an emergency procedure and this was an emergency! It was the most dangerous of maneuvers of night aviation. Without visual references, flying within a hundred feet of the water could be a 'one-night stand.'

Carrot was slapped in the face by a wave. He was in the water! What happened! The helo had hit the water and the aircrew had been thrown from it as the craft disintegrated.

The aircrew huddled together for warmth and security, they hoped and prayed for their comrades to rescue them. Besides cuts and bruises, no one was hurt. However, the helo was lost!

Ozone was beside himself. His Navy career had just concluded. The helicopter aircrew were eventually rescued. The original man overboard alarm proved to be the imagination of an anxious lookout.

The next day, Ozone was a celebrity onboard the ship. It wasn't just anybody that could drive a helo into the ocean and come back, much less come back without a scratch!

There was to be an accident board. This board would be comprised of other helo pilots and together they would review all the events surrounding the case. It would convene in two days.

Ozone had two days to get his flight records into shape. Surely the accident board would ask for the helo squadron's flight schedules and records for all involved in the accident.

The evening before the board was a busy one for the flight record petty officers. They worked to compile an accurate picture of the flight qualifications of the downed aircrew. One glaring problem stood out. It seemed that their boss, Ozone, had gone flying that night without a night qual. This would be damning to the helo commander if it were brought to light in the investigation. To fly at night without a night qual was a serious mistake alone. However, to do this and crash an aircraft was the end of a career. If only the flight records had been maintained in a more professional fashion, this scheduling error probably would never have happened.

III. TEACHING NOTES: MAN OVERBOARD

A. Overview

A database can be a solution to certain organizational and operational problems. The development of a database and the ongoing maintenance it requires can be unique to each organization. However, there are certain commonalities to all databases and those qualities can be extended to fleet applications. The need and uniqueness of each database can be demonstrated only by the existing organizational record-keeping system.

There are two objectives of this case study. Primarily, this exercise is designed to introduce a student to the use of computer-based information systems and to the database concept. This is accomplished through the demonstration of the needs that can be satisfied by the institution of an information system and a database management system in an organization.

Secondly, this case study demands innovation in database organization from those relatively new to automated data processing as well as seasoned MIS professionals. A programmed solution to the database problem posed is provided for the teacher to demonstrate.

Generally, the problem here is the lack of a computerized information system and database management system in particular. Accurate compilation and maintenance of records of any kind requires some sort of efficient database management system. This squadron does not have a working database system. All unit-level commands in the U. S. Navy (which includes such squadrons) possess desktop personal computers and most have database management software. This helo squadron possessed the hardware and software to effect an improved system of database management. Normally, unit-level commands have at least one person that understands PC's and could construct a database for applications such as flight records. However, this is not always the case. It must be kept in mind that possible solutions to lack of training in personal computers and database management systems is part of the solution in this case study.

This case is about a problem in records maintenance. For a group of MIS students, it may immediately suggest a need for a DBMS. However, that solution provokes the question, by what metric is DBMS better than the present manual method of keeping records? Students may assume that a DBMS is better, that it is patently obvious. They must justify this as a solution in terms of expected performance of the system as well as costs and benefits to the organization.

The case also implies a leadership issue. A DBMS may be suggested as a solution and to that extent, students may be

substituting information technology for the possibly deficient leadership on the part of the operations officer.

Employing information technology can enhance a career, chiefly be improving effectiveness at handling a job. Some students may suggest that information technology is just another bit of DOD faddism, another wasteful boondoggle...

The squadron had no database. Therefore, its records lacked completeness, accuracy and an audit trail for all squadron operational and administrative functions. This was true even though the squadron had the requisite hardware and applications software. These resources were not being used. Using them, trying them, investing in learning them was not going to make anyone a hero on their next fitness report. Worse, people who monkey around with this technology might be labelled as a hacker nerd rather than being pictured as a capable ship driver or aircraft jockey.

How are MIS graduates going to train people in the fleet to start putting the information technology to work for themselves and their mission? How are junior enlisted going to learn something as potent and possibly productive as DBMS unless CSM graduates teach them. If they don't learn it, the fleet loses a good measure of potential gains in productivity. Yet, we won't do it if the CO or XO looks upon it with disdain.

This squadron, as a microcosm of similar tactical level field/operational units, probably needs to create a new organizational billet for a database administrator.

Someone schooled in the organizational advantages that flow from employing information technology has an obligation to pole and prod CO's/XO's to appreciate those advantages and encourage adoption of the technology.

-- Push students to specify these advantages.
-- Lead them into a discussion of the "how" of prodding senior superiors.

Should responsibility for an MIS activity be a collateral duty -- as it is now -- or should it be the primary billet of an MIS graduate?

---Resistances to this decision that pursuing MIS would wreck my career; the opportunity cost would be missing the chance for operational command.

---Yes, but Ozone wrecked his career because he lacked the support of an information system.

A technical aspect of this case can include a discussion of the need for data standards in the maintenance of a DBMS.

What ought to be the division of labor between commissioned ranks and enlisted ranks in dealing with IS? One suggestion can be that officers should have the skill to create applications that will benefit the work of their departments while enlisted personnel ought to be involved in running applications, doing data entry, generating reports and making database queries. A dimension of this discussion must be that some officers have no computer literacy while many enlisted people are computer wizards. There are aspects of social structure here (rank, hierarchy, dirty hands avoidance, etc.) that are barriers to this division of labor or to the usage of the skills possessed by lower ranks.

Another technical aspect of this case is the question of what kind of data base would be appropriate: relational? flat file? network? This is an opportunity to apply a grasp of the advantages and disadvantages of each database architecture gained in earlier courses.

B. Case Use

This case study was prepared for use in the Computer Systems Management Curriculum at the Naval Postgraduate School, Monterey, California. It can also be used by students from other curricula, studying the basic concepts of information systems. The case is of particular value in introducing the need and usefulness of management information systems. It has application in demonstrating the needs for an

organizational database to students to IS 3183, 'Management of Information Systems.'

C. Analysis of Case

(1) Problem Statement:

The squadron operations department currently lacks a sound database management system designed to track the operational performance of aviators.

(2) Author's Analysis:

Quite simply, there was no accurate database of flight hour or flight qualification information. Also conspicuous is the lack of a knowledgeable database administrator.

(3) Recommendations:

Personal microcomputers are in place in unit-level commands such as this squadron fleet-wide. Database management software (e.g. Ashton-Tate's 'dBase IV') is available to this type of command. Squadron personnel should be charged with the specification or creation of a database application specific to the needs of the organization. This solution to squadron necessities should be tested, implemented and offered to similar aviation commands. Should there be a

lack of database management software-trained individuals, the appropriate training should be provided by the organization for those who would use it.

A database administrator, preferably an officer or chief petty officer, should be installed to oversee the proper maintenance of the flight record and any other database to be used by the squadron.

Both fully relational and non-relational database management systems should be considered in the selection of the database management software. In either case, the software to be chosen must be PC-driven and user-friendly.

IV. TEACHING CASE 2: SUBNET

The 0530 brief was called to order in the helicopter squadron ready room aboard USS Ranger, a conventionally-powered aircraft carrier. Helicopter aircrewmen took their seats. They awaited information about an upcoming ASW (antisubmarine warfare) mission. Ltjg 'Snake' McDonald was the Squadron Duty Officer (SDO) that morning. He had been up all night preparing this tactical brief. The Ranger battlegroup was beginning the ASW phase of their operational evaluation prior to their Western Pacific/Indian Ocean '89 Cruise.

This case was prepared by Lieutenant Marc The'berge, USN, as a student at the Naval Postgraduate School, under the direction of Prof. William Haga. It is designed as a basis for class discussion.

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Helicopters are important players in battlegroup ASW. Specifically, carrier-borne SH-3H Sea King helicopters are employed to use different forms of sonar to identify, locate and track submarines. They also can be armed with torpedoes to attack submerged targets. An H-3 helo can use its variable depth sonar to locate, track and target subs. They can also employ sonobuoys which are air-launched, salt water-activated listening devices for the same purposes. By using sonar and sonobuoys, as well as acoustic homing torpedoes, the H-3 is a formidable opponent for any submarine. Normally, the H-3 helicopter is used to protect the aircraft carrier and other battlegroup ships from underwater attack.

Snake began with the weather report. It was to be a sunny day in Hawaiian waters. Miles of visibility and no clouds were predicted.

Next, predicted acoustic conditions for the operating area were given by Petty Officer Third Class Vasquez. He provided predicted ranges for passive and active detection for sonobuoys and the H-3 dipping sonar against the day's TOI's (targets of interest). Of course, as all helo aircrew know, these predicted conditions are never very accurate and it takes a BT (bathythermographic reading) on the spot to really know the acoustic conditions of the ASW battlefield. Once BT's are taken by the helos and transmitted back to the ship's ASW module, they can provide useful tactical information to ASW aircrew. That is, it will be useful if the information

gets to the aircrew in time to become integrated into the tactical plan. In the heat of battle this rarely happens.

Two helo crews were told they would be flying as an ASW screen for the carrier. The helo skipper and the Ops officer were the 'Hacs' (helicopter aircraft commanders) in this screen. They would deploy passive sonobuoy patterns in front the ship, searching for hostile submarines. If they got a potential submarine contact, they would use active dipping sonar to simulate multiple fire control solutions in this exercise. Simultaneously, upon receiving word of a hot contact, a third aircrew would join in the underwater hunt. Lt. 'Razzle' Simons and Ltjg. 'Dazzle' Davis, would man the alert helo.

After the assignment of aircraft to each of the aircrews and a detailed discussion of the tactics, the brief concluded.

As usual, aircrew were directed to the ASW module for answers to their questions about the conduct of the mission.

It was 0630 as the flight crews moved to the mess for breakfast.

Snake mentally patted himself on the back for putting together a strong brief. The squadron maintenance department chief hailed him over the 'bitch-box.' The chief said it was unlikely that the squadron would have three functional aircraft for the day's first event. Probably only two would be available. The skipper would have to be informed but the

chief advised that it would be better to tell him after breakfast. Snake agreed.

In Ranger's Flag Tactical Command Center aboard Ranger, Lcdr. 'Hoops' Ball received information from battlegroup electronic support measures (ESM) about the location of 'bad guy' submarines. Being a F-14 radar intercept officer, he entertained the idea of launching a couple of Tomcats to investigate. He decided to discuss the situation later with his relief during passdown of his watch. It was now 0700. The ASW exercise was to begin at 0900. That ESM bearing was directly across the carrier's planned track.

Up on the bridge, Captain Tom Gallery was watching the morning flight deck activities from his CO's chair. He was proud of his ship and looked forward to a day of victory in the battlegroup exercises. He took the occasion to broadcast over the ship's public address system a reward of duty-free liberty in the next port for any sailor sighting a periscope that day. If anything would keep the lookouts alert for submarines, extra liberty would.

The helo crews manned up their aircraft for the 0830 launch. During preflight check, the skipper's aircraft went down with a fuel leak. Snake had forgotten to tell the skipper about one of the helos being down for the day.

The helo skipper was furious. He ordered the Ops O to hand over his aircraft to him. The Razzle-Dazzle crew, watching from the flight deck, thought this was hilarious

until it dawned on them that they could lose their aircraft to the Ops O!

The ASW module was already receiving reports of periscope sightings. All wanting a duty-free port visit. There were going to be a lot of those reports. The one phone line to the module was going to be busy all day.

The helo squadron maintenance department was in an uproar! Aircrew were playing musical aircraft on the flight deck. It was rumored the CO, in all his rage, had fired the maintenance officer! There was no way the below-deck managers could get a firm grip on flight deck evolutions. The maintenance chief called Snake again, "Sir, we've lost the bubble."

Snake was in the middle of passdown to his relief and was too tired to care. No one seemed to know what was going on! Getting through to the ASW module for a tactical update was impossible.

By 0840 no helos were airborne. Captain Gallery called the helo ready room for an explanation. Snake's passdown to the new SDO was useless. Too much was happening! The new SDO, Lt. Cowboy Taylor, had told Snake to go to bed and he would take care of everything. Cowboy had barely gotten his first chaw of Redman when the captain called. At a loss for words, Cowboy swallowed his chaw.

Tactical Flag had undergone a passdown too. The new watch officer took interest in the ESM information from earlier that morning. Just then, he got another tipper about

a possible sub. He tried to call the helo guys to let them know. Unfortunately, the helo ready room phone was busy.

At 0910, the helo skipper was ready to launch. The flight deck was back in order; Razzle and Dazzle were positioned in the alert helo. Tactical Flag got through to the helo ready room but with the launch imminent, no information could reach the helo. The ASW module was still deluged with reports of submarine sightings. The helo finally launched.

From the bridge, Captain Gallery saw a green flare burning in the water off the port bow. Green flares are simulated attack signals from submarines to surface ships. The carrier had become a simulated kill. The battle was over before the carrier had started to fight!

"What the hell happened?"

The airborne helo too, saw the green flare. "If I've still got a job when I land I'll find another way to do business!" the helo skipper moaned.

V. TEACHING NOTES: SUBNET

A. Overview

A major issue of information systems technology is the decentralization of information. Systems analysts must study information needs in-depthly in order to adequately build a system which will suffice those needs through decentralization. Whether or not decentralization is really necessary in a system can only be determined through actual observation of the information distribution technology already in place.

The dilemma faced by the organizations in this case study is the lack of an automated system of distributed information sharing. Rapid and accurate sharing of information requires a distributed processing system such as a computer network. The organizations presented are engaged in an antisubmarine war-fighting effort without such a system.

Naval warfare today is characterized by a large degree of information sharing. Currently, aboard U. S. aircraft carriers, most tactical information is distributed via phoneline and voice. This process is time-consuming, limited and prone to error. The introduction of automated distributed systems such as the local area network (LAN) could improve the state of tactical information sharing onboard

carriers. Tactical advantage can be preserved and enhanced by an accurate and timely flow of battlefield intelligence. Electronic message processing and accessibility to common databases coupled with savings in hardware expenditures are advantages to be gained for any organization through the implementation of a local area network.

All unit-level commands in the U. S. Navy (which includes ships and aviation squadrons) possess microcomputers. Network hardware and software that can link microcomputers of separate commands aboard a ship is currently not available. Therefore, tactical information sharing amongst naval shipboard microcomputers does not exist.

Accordingly, tactical efforts, such as carrier-borne ASW are not armed with the hardware and software to improve a system of information resource management.

By way of synopsis:

** The primary objective is to integrate multiple application subsystems to form a comprehensive, integrated ASW information system.

** The secondary objective is to enable a better communication system between various ASW assets in order to achieve a more efficient command and control process.

There are three objectives of this case study. Primarily, this exercise is designed to introduce the new MIS

student to the distributed system concept. This is accomplished through the demonstration of the needs that can be satisfied by the institution of a distributed system in the form of network in a organization. Secondly, this case study demands innovation in local area network organization from those relatively new to automated data processing as well as seasoned MIS professionals. This is achieved by assigning students the task of solving the question at the end of the story. A solution to the information resource problem posed is provided.

What is revealed by the maintenance chief conveying the message that a helo is down but, in effect, don't tell anyone, especially not the skipper or at least not until he has had a decent breakfast.

The central issue in this case is local area networks. Would a shipboard LAN be the final solution to the difficulties portrayed in this case? First, permit the students to generate their own suggestions for a solution. But that discussion can only be fruitful if they fist have a clear idea of the problem. Some time must be invested in a sound framing of the problem. Then release them to pursue solutions. One suggestion will surely be the installation of a LAN.

What is the state of shipboard LAN's? Is the equipment and software in lace? If in place, is it being used? What are the barriers to the use of such systems? CO/XO

disinterest. Untrained department heads/division officers? Lack of trained enlisted personnel? Lack of time to get involved in readings documentation, learning systems? Can we attribute and increase in tactical effectiveness to the use of a shipboard LAN? Can we quantify tactical effectiveness in a way that allow any causal inference related to other variables? The point of this case is tactical effectiveness failed in this instance. Whether quantifiable or not, the CO had a clear sense of his ship's tactical effectiveness and so did everyone else aboard shortly afterward.

Conceptual elements to consider in a model of shipboard information:

Weather

Sea conditions (temp, salinity, thermal layers)

Mission

Players (assignment of aircraft as a function of aircraft maintenance.

Tactics

Tactical operations such as the helo receive and must juggle information from as many as six sources, all separate and distinct and ignorant of the others.

How effective can a helo pilot with all of that information flooding in....or key information not coming in at all? The flag control center was whelmed by all kinds of

information. For example, all ASW information is routed there first before it foes to the ASW module. Some self-promoting people send every communication there as a way to keep themselves visible to the skipper and his staff.

There is a problem with information that is hidden from others of simply is lost in a shipboard information flow. Would a LAN overcome that problem? What were the behaviors of staff people with what was essentially hot operational information?

What about the CO in this case? His wish is everyone's command. He wants to find a sub! Better to risk a multitude of false alarms than miss the one time it is real.

The helo crews on deck don't know what's going on down in the ready room. Likewise, the ready room has no clue as to what is happening up on deck. The ready room doesn't know a helo is down. The helo skipper "fires" the helo maintenance officer. Now the maintenance people don't whether this is serious or an instance of anger and frustration. They don't, in the heat of the moment, know to whom to turn for direction.

The ship CO hits the new watch officer just as he is coming on duty. He is asked what is going on when he has the least informed person in the scenario. With crew switches taking place, no one is informing the ASW module because the phone lines are busy with false sightings of subs. Could the officers use the squawk box? Sound powered phones? Or does protocol dictate that they must use the telephone?

Describe the communication/information situation in the ASW module. There seemed to be no way to inform the launched helo of the information of an actual sighting. Cannot pass tactical information on unsecured channel. Telephone lines are routed through the ASW module but all lines are busy.

The final objective is to demonstrate a benefit analysis of two local area network solutions to the case study problem.

B. Case Use

This case study was prepared for use in the Computer Systems Management Curriculum at the Naval Postgraduate School, Monterey, California. It can also be used by students from other curricula, studying the basic concepts of information systems. It has particular application demonstrating the needs for an organizational database to students in IS 3183, 'Management of Information Systems.' The case is of particular value in introducing the need and usefulness of management information systems.

C. Analysis of Case

(1) Problem Statement:

The tactical antisubmarine effort depicted in this case study lacks a sound information resource sharing (network) system designed to keep warriors informed of the latest battlefield developments.

(2) Author's Analysis:

Quite simply, there was no adequate method of sharing information resources. Information pertaining to tactical developments, equipment maintenance, ship's operational planning, weather and intelligence was not being disseminated amongst the organizations that needed it most! Shortcomings of the aircraft carrier and helicopter squadron in networking and information distribution resulted in the tactical defeat of a capital ship and strategic asset of the United States.

(3) Recommendations:

Personal microcomputers are in place in unit-level commands such as the aircraft-carrier and helicopter aviation squadron fleet-wide. Network hardware and software (such as the examples provided in the economic analysis section of these notes) should be made available to organizations such as aircraft carriers. The very survival of such multi-billion dollar organizations can depend upon the implementation of a distributed information application specific to the needs of the organization. Local area network technology and training must take its place in U. S. naval organizations, such as an aircraft carrier. Shipboard information resource-sharing requirements are not satiated without network technology. Should there be a lack of personal computer and network-trained individuals, the appropriate training should be provided by the organization for those who would use it.

Both the hardware and software to be chosen must be PC-driven and user-friendly.

The system should be designed to connect the following activities aboard the aircraft carrier: the ASW helicopter squadron ready room; the ASW fixed-wing (S-3) squadron ready room; weather services; air wing maintenance control; the ASW command module; the ship's combat information center; the ship's bridge; and the tactical flag command center. Each of these activities will be a node in SUBNET.

The topology for SUBNET will be a modified star design. This design is illustrated on the following page. The design was determined so as to ensure network survivability in case of the loss of any node. The transmission medium to be implemented in the network will be shielded coaxial cable. This medium is impervious to the large amount of electromagnetic interference to be found onboard ship. Also, this is the least expensive of the qualified alternatives.

Technical considerations will be the most important issues in the selection, implementation and maintenance of a carrier-based ASW LAN. The system to evolve from this decision statement and its implementation followup will be named SUBNET. A summary of priority features for this proposed network is provided in the following pages.

Specific requirements for SUBNET include the range of functions to be performed as well as responsiveness of the system. Functions to be performed by this system include:

electronic mail (PC MAIL); database management (DBASE IV); word processing (WORDPERFECT); and spreadsheet processing (LOTUS). The LAN should process and manage these functions with minimal user waiting time.

SUBNET hardware will be comprised of existing Zenith-248's and a 386 LAN file server system to be determined. Software for the network will also be determined. Hardware and software required for the system will be purchased as one off-the-shelf package. Shielded coaxial cable will be selected to connect the network as it is relatively inexpensive as well as impervious to electromagnetic effects. DEC's PCLAN/SERVER and the 3+OPEN LAN MANAGER, VERSION 1.1, are the two alternatives chosen for study in this case. The following tables illustrate their respective attributes.

	PCLAN/SERVER 3100	3+OPEN LAN
LIST PRICE	$12,500 (INCLUDES SERVER)	$3495
NETWORK OPERATIONS		
FAULT TOLERANCE	X	X *
# OF SIMULTANEOUS LOGONS	64,000	1,000
SERVER SOFTWARE		
NUMBER OF SERVER DISKS	7	12
ADD'L O/S REQUIRED	VMS	OS/2 (INCLUDED)
DISK CACHING	X	X
RAM	414K TO 520K	520K TO 589K
FILE SERVER INFO		
CONCURRENT OPEN FILES PER SERVER	UNLIMITED	8,000
DRIVES PER SERVER	14	12
MAX FILE SIZE	4GB	2GB
TOTAL DISK STORAGE	4GB	7.5GB

	PCLAN/SERVER 3100	3+ OPEN LAN
ADMINISTRATION		
KEEPS ACCOUNTING BY USER OR RESOURCE		X
REPORT #BAD PACKETS	X	X
REPORT NETWK ERRORS	X	X
MONITORS OPEN FILES		X
SHOWS NAMES OF USERS LOGGED ON		X
SHOWS % SERVER USED	X	
SECURITY		
ACCESS CAN BE DETERMINED BY GROUP	X	X
ACCESS VIA LEVEL	X	X
USER FEATURES		
E-MAIL (STORE & FWD)	X	X
PRINTING		
PRINTERS SUPPORTED	16	32

An important aspect of this hardware and software selection process for SUBNET will be cost comparison. The 3+OPEN LAN MANAGER definitely has a cost less than its competitor. Even though a 386 LAN server must be purchased separately, this will not make a great difference in overall cost, assuming $4000 for the server.

A priority of great importance to SUBNET will be its sailor-proofing. This system must be able to withstand daily interface with largely computer-illiterate personnel. Fault tolerance, or the ability of a system to recover after erroneous inputs and component failures, will be a major strength of the system. Both of these systems possess this feature.

E-mail is a feature of both systems. A store-and-forward message system is entailed in both networks being considered.

Security is another desired feature of the network to be chosen for SUBNET. Both systems under consideration have password security as well as access to the system determined by group.

All of the desired features for SUBNET are to be found in both systems under consideration. The benefits of both alternatives are therefore roughly the same. The 3+OPEN LAN MANAGER is therefore selected because of its lower cost.

Students are invited to comment and criticize this selection as well as originate their own solutions to the problem.

VI. TEACHING CASE 3: SUBTRACK

Eleven hundred feet of aircraft carrier slid by the International Dateline. The sun was just up. All was well for the men and the ship.

It was an 0600 launch. The flight deck was just waking up aboard the USS Ranger. The dawn patrol today consisted of the ship's lifeguard, the SH-3 Sea Pig. It's job was to fly ahead of the carrier, searching the ship's track for obstacles such as any fishing nets, ships or islands that might be in the way. Ranger was tracking east for San Diego at the end of six months of cruising. She turned windline.

The helo was 'up & up' for the day's recon as well as antisubmarine warfare (ASW) if the need arose. ASW was the real mission of the helo drivers and they were good at it!

This case was prepared by Lieutenant Marc W. The'berge, USN, under the direction of Prof. William Haga, as a basis for class discussion.

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However, glasnost, perestroika and not being anywhere near a sub for the entire cruise had fostered apathy for the ASW mission.

Search and rescue work had been the order of the day for the rotorheads for the last 180 days. Nothing was more boring than wasting away one's young life waiting for others to fall overboard. The helo boys were out for an early morning joyride and nothing more. The whirlybird hurled itself at the horizon making all of eighty knots.

Time was 0630. Thirty miles out from the carrier, Lts. 'Ready Freddie' Taubman and 'Fast Eddie' Glickstein began to arc back and forth ahead of the ship. Together, they were known as 'The Pros From Dover.' Freddie wasn't too swift, which made him all the more loveable of a helo guy. Eddie was the intellectual. To pass the time at sea, he read the likes of 'The Adventures of Teenage Mutant Ninja Turtles.' These two were definitely the right stuff!

Time was 0645. The H-3 droned on ahead of its ship, arcing from 315 degrees to 045 degrees relative to the heading of Ranger. They held an arc of 30 nautical miles as they flew across the Pacific. It was normal for H-3's to maintain altitudes of 150 to 300 feet above the sea level.

Like a mirage in a desert, Fast Eddie saw what he thought was a periscope. They called in with the time and position of the submarine sighting. It wasn't known whether this was a good guy or a bad guy sub. Once in six months, they had

some excitement as they began to weave the black art of ASW about their prey.

In the Ranger ASW Command Module, Lcdr. 'Hoot' Hawler was standing watch over consoles and receivers processing ASW input. At the first contact, he "roger'd" the helo and told it to passively investigate the sighting. "Probably a school of fish," he told himself.

Of more interest to Hawler was a method of training himself and his men in the manipulation of their acoustic processors and particularly the actual steps to follow in case of a real underwater attack. He just didn't know enough about ASW. Nor did he feel anybody else onboard was qualified, to confidently make recommendations to the carrier skipper about the conduct of a capital ship in battle with a submerged opponent.

Time was 0700. Contact was held at 30 nautical miles dead ahead of the carrier. The carrier was steaming due east at 15 knots. The 'Pros from Dover' dropped a pattern of passive buoys to investigate their contact. Then they began monitoring the buoys for acoustic responses to transmit back to the Ranger. Initial course and speed on the target was 360 degrees True at 7 knots.

Time was 0715. The helo crew was excited. They were now matching wits with a potential adversary. However, they weren't getting much of a reaction from the carrier. "Hell," thought Freddie, "we're out here doing our job up against what

could be the start of World War III and those yo-yo's back at the ranch just keep steaming into torpedo attack range."

Eddie likened the vulnerability of the oncoming carrier to the battlewagons at Pearl Harbor in 1941.

Time was 0745. The submarine changed course and was closing on Ranger. The helo crew radioed the change back to the ASW Module. Lcdr. Hawler was visiting the head when this news came in. A senior chief heard the radio call and notified the ship's Combat Information Center that an unidentified submarine was closing on them.

This news spread fast. The ship's captain knew about the sub by 0820. By this time, the reported position of the submarine was 350 degrees relative to Ranger at a distance of 10 miles. The skipper wanted to change course to increase the distance between Ranger and the sub. However, the morning's first launch and recovery of aircraft was in full swing. He decided to finish with the aviation business of launching first. Then he'd check on what the helo guys had to say.

Time was 0830. The ASW Module had compiled acoustic data from the helo. It seemed the sub was a foe, likely modern and nuclear-propelled. The Ranger CO didn't care about that. "Damn it," he yelled, "we're at peace, now finish the aircraft recovery!" The ship steamed on, holding its course.

Time was 0845. "The Pros" had an active dipping sonar contact on the sub. Sonar contact was intermittent. They

weren't losing this guy, but, he was definitely trying to shake them off.

Eddie looked over his shoulder and saw Ranger 5 miles back. It looked like the morning air recovery had just ended. If the submarine had wanted to start shooting, the war, for the Ranger, would be over.

Time was 0900. The Air Boss called the helo in for a hot pump/crew switch. They broke off contact with the sub and headed back to the ship. Freddie was furious that the ship had ignored their warnings and steamed into what could have been harm's way. Even a small change in the ship's course could have made a big difference. Expertise was needed for the carrier and fast!

Hawler was aware of what had gone on. He called down to the helo ready room and asked the helo pilots to debrief him. Before he spoke with the Ranger CO he wanted the whole story and a way to prevent this from happening again.

VII. TEACHING NOTES: SUBTRACK

A. Overview

Decision support is an area of information technology with tremendous potential for fleet applications. Decision support systems (DSS) can embody entire tactical doctrines in order to assist the human decision-maker in difficult situations such as the 'heat of battle.' DSS are used to help solve semistructured problems (managerial or tactical) typical to the world of the naval officer. Problem identification, alternative solution formulation and solution evaluation are all features provided by the information technology inherent to the decision support system.

This case is a look toward the future of shipboard IS, particularly an application of a decision support system.

The opportunity here is that many of the CSM students' grasp of DSS is oriented to the level of writing code. What they need is a scenario in which they can deal with putting a DSS to work to some organizational purpose.

The ASW module in this case is not listening to the request from the helo for guidance. The response is not forthcoming because the ASW officer is without a clue as to how to proceed tactically. Information is available but the ASW module lacks any model of tactics as to how to make use of

that information. Explicitly, the ASW officer has no training in deriving tactical solutions.

The concern here is whether the students will see DSS as the solution. Again, the problem is not information sharing as it was with SUBNET, but rather information processing, transforming data into elements for decision making. Would a DSS clear up the limits and difficulties portrayed in this case?

A technical issue here is whether the solution is a DSS or an expert system. Is the need for a system that supports decision making or for a system that makes the decisions?

What organizational structure will support the effective use of a DSS in this situation? Describe the structure now. Then, describe how it might be altered to advantage.

B. Case Use

This case study was prepared for use in the Computer Systems Management Curriculum at the Naval Postgraduate School, Monterey, California. It can also be used by students from other curricula, studying the basic concepts of information systems. It has particular application demonstrating the needs for an organizational database to students to IS 3183, 'Management of Information Systems.' The case is of particular value in introducing the need and usefulness of management information systems.

C. Analysis of Case

The anti-submarine warfare (ASW) defense of an aircraft carrier is characterized by large inputs of raw information which must be processed and refined quickly to produce a course of action. Tactical data are transmitted to the ship and thence to the ASW Command Center for dissemination to the ASW staff experts to assess the current tactical situation and prescribe course of action. The nature of the problem that ASW experts will solve is determined by the level of ASW knowledge onboard, intelligence about the ASW threat and enemy tactics. The problem is the stress of the battle which produces costly errors at the worst times. This problem is developed in a three-level arena of above, below and on the ocean.

The users of this proposed expert system are the ASW decision-decision-makers involved in the assessment of the initial submarine contact. These users are experienced professionals in not only ASW but also high technology interfacing with tactical decision-making. However, the current use of computers in solving these problems is limited to the analog analysis of raw acoustic information and the decisions made are entirely human.

The purpose of this proposed system is to provide the ASW experts with an assessment of the tactical situation integrated with current intelligence data based upon threat information. Accordingly, a more accurate distribution of

knowledge will favor an ASW decision-maker. This organization of knowledge will instill in the user a familiarity with the latest ASW expertise. As human errors will be reduced by interaction with this system, more consistent decisions will be reached and the costs of training professionals will be significantly reduced.

This system will suggest the initial action to take when faced with an unidentified submarine contact. This system will be designed for an open-ocean deep-water operating environment. Peacetime steaming practices and alert status are assumed in this scenario. This system will compile all information on the unidentified contact, the analysis of the threat posed and infer the initial recommended action. Information such as magnetic and acoustic signatures, visual sightings and ESM detections will come from fixed- and rotary-wing aircraft and surface ships dispersed about the carrier itself.

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